Problem G: Escape from the Mines

Things take a turn for the worse inside Pankot Palace, as Indy and friends discover an underground temple where human sacrifices are executed, and they find that the village children are being enslaved mining the mountain.

The stone they search is finally recovered, and they are about to flee as quick as possible, but they can't leave the children there! Short Round has the keys to help the children, and after freeing them, he must reunite with Indiana, who is fighting a guard.

Figure 1: The village children escaping

We will assume that the mines can be represented by a rectangular grid, and that each step can be taken in one of four direction: up, down, left or right. Help Short Round find the minimal number of steps to go from his current place, to Indy's location, after going through all places where children can be found in order to free them.

Input

Input starts with a positive integer **T**, that denotes the number of test cases ($T \leq 100$).

The first line of each test case contains three integers, **R**, **C** and **H**. R and C are the number of rows and columns of the map, respectively, and H is the number of cells where children can be found. $1 \leq R, C \leq 100$. $0 \leq H \leq 6$.

Then R lines follow, each one with C characters, representing the maze. Each character can be:

- The letter **S**, which denotes Short Round's initial position.
- The letter **I**, which denotes Indy's position, and Short Round's destination.
- An at sign (**@**), which represents a cell where a group of children stands.
- A dot (**.**), representing a free cell.
- A number sign (#), representing an obstacle. Short Round can move freely throughout the mines, except in cells where an obstacle is found.

You can assume that there will be exactly one cell with the letter **S**, one cell with the letter **I**, and H cells with an at sign (**@**).

Output

For each test case, print the case number, and then print the minimal number of steps to get to Indy, after freeing all children, or print **impossible** if it can't be done.

Sample Input

```
2
7 11 3
###########
#....S....#
#......@..#
#....###..#
#.@..#@...#
#....#...I#
###########
5 9 0
#########
#...#...#
#.S.#.I.#
#...#...#
#########
```

Output for Sample Input

```
Case 1: 22
Case 2: impossible
```